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IMPLICATIONS OF CHANGES
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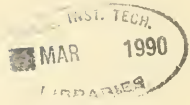
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Working Paper

Management in the 1990s





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Management in the 1990s
Sloan School of Management
Massachusetts Institute of Technology

Management in the 1990s is an industry and governmental agency supported research program. Its aim is to develop a better understanding of the managerial issues of the 1990s and how to deal most effectively with them, particularly as these issues revolve around anticipated advances in Information Technology.

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Implications of Changes in Information Technology
for Corporate Strategy

Introduction

This paper is deliberately narrowly focused. It does not deal with a large number of important issues in the fascinating and constantly evolving field of corporate strategy. It contributes, as do the other papers in this issue, to the mosaic which somehow defines the elusive concept of corporate strategy. As is so often true in emerging fields, no one has yet been able to define the concept and identify the elements in a way that is satisfactory to all people who consider themselves to be in the field. Nonetheless, the substantive work represented by all the articles in this issue attests to the constantly evolving nature of the field and each contributes to this evolution.

The work discussed in this paper is a small piece of the strategic planning domain and deals not at all with the process of planning but rather with one piece of substantive content that organizations are using to create strategic moves that will help them deal successfully with the future. The work discussed here is part of a project that is ongoing in the Sloan School. It logically follows from Chandler's⁵ classic study "Strategy and Structure" written at MIT in 1962. Chandler's book, which has been through eleven printings in the intervening years, is an example of the richness and complexity of the field of corporate strategy.

In this work, among other things, Chandler developed some of the first notions of causality and balance in organizational processes and structure. He observed that in his sample of organizations the organization structure of the firm was changed to follow the strategy the firm was pursuing. For example, as executives at DuPont in 1919 decided on a strategy of aggressively extending their business out of munitions and into industrial chemicals they changed DuPont's organization structure and reporting relationships to reflect this strategic change. In a broadly analogous way, it is generally believed today that in successful firms, information technology should be managed to support business strategy and must fit the current organization structure.

However, the main argument of this article is that this previously perceived one-way view is too limited. Beyond the use of information technology to support the existing business strategy is the opportunity of using information technology, proactively, to create new opportunities for the business. These new strategic opportunities are being created by a broad range of information technologies. They not only lead to new markets and new products but also provide whole new ways to manage the firm.

This double linkage of information technology supporting the business strategies and information technology creating opportunities for new business strategy is an important phenomenon. It now appears to provide successful firms with a powerful competitive weapon in their strategic maneuvering to find ways of providing their shareholders with decent returns. Before developing the main argument it is necessary to step back and define some terminology and identify some of the background events that are making these changes possible.

Information Technology - An Historical Perspective

In 1958, Leavitt and Whisler¹¹ predicted in their article in the Harvard Business Review that the advent of the computer and management science would significantly change the structure and processes of most corporations. In addition, they suggested that the roles of top executives and others in the corporation would be significantly changed with this new technology. For almost a quarter century since the publication of the article, little evidence has been published to suggest that they were right. Most of the commentators who have summarized the evidence to date (e.g., Hofer,⁸ Bariff and Galbraith,² et al) have found some evidence of a few changes in some organizations. But, on the whole, there has been nothing to become excited about. No truly significant changes were observable.

Looked at in retrospect, this is not surprising. In our view, computer-based systems have passed through three separate "eras" of use. The first two of these - during which almost all of the published research data has been gathered - were concerned primarily with computerization of the paperwork processes of the firm. One would expect few changes in an organization to be caused merely by changes in the way paperwork is processed. In the first era accounting functions were automated. In the second, during the mid to late sixties, the emphasis changed from systems aiding the accountant to systems aiding first-line operational personnel. In this era, manufacturing control systems and

on-line order-entry systems were instituted. As in the first era, most of the second wave of systems merely enabled companies to process paperwork faster and more accurately.

The Third Era

During the past several years, however, a "third wave" of computer applications has begun to sweep in. In contrast to the earlier two eras, in which accounting and operational systems previously carried out by clerks and first line supervisors were automated, this third era of applications focuses on providing information to middle⁹ and top management¹⁵ and on facilitating both data analysis and communication of analytic results and other facts. This era can be termed the "information-communication" application era and is the one fueling the strategic changes commented on in the next section.

This third wave of applications has been engendered by profound changes in the technology (both hardware and software). A major result of the increasingly powerful and diversified technology (of which we say more later) is to make available to every user a full smorgasbord¹³ of computer power, each type of power available in the smorgasbord being appropriate for a different class of problem. One recent example of this changing range of power has swept personal computers into the manager's view and a considerable number of them are becoming more computer literate than even they would have believed possible as recently as 1980. Of the more than 2,000,000 personal computers sold some 70% are guesstimated (Toong and Gupta)¹⁸ to be in the hands of professionals, many of whom are managers. This change in "literacy" is one of the facts driving us into the information era.

The "third era" has been given further momentum by a variety of environmental conditions which include such things as inflation, the internationalization of the world-wide slump in economic activity and the changing social forces. All of these factors combine to create a turbulent external environment that requires imagination and thoughtfulness of the part of the company's management. One of these solutions is a significant overhaul of the management of computer-based functions. The results of a recent poll conducted at the 14th Annual Society for Management Information Systems (SMIS) in September of 1982 strikingly illustrates this. At this conference there were about 300 people in attendance with well over 100 organizations represented. In an informal poll of the participants, a number of patterns began to emerge which were sharply different than those in a similar poll conducted some two years before. The 1982 Conference's poll revealed that some seventy percent of the participants, had, in their organization, either put office automation (white collar productivity) together with data processing in the same organization unit reporting to the same director or vice president, or they had put communications and data processing into one department. The same poll revealed that fifty percent of the organizations represented at the conference had put all three activities (office automation, data processing, and communication) into the same organization reporting to the same head. In other words, seventy percent had put at least two of the pieces together and fifty percent had put all three together. The title of the person who is responsible for this combined operation was in many cases director, or manager, of the information services department. They had dropped the term "data processing" and replaced it with "information services."

What we see, then, with the changing technology is an evolution in the management of this change. In the early sixties we had the EDP department (the electronic data processing department). This in time gave way to the shorthand DP (data processing) Department and then in the seventies we had a great many departments that changed their names from "data processing" to "MIS." This became the trend from the late sixties through to the middle and end of the seventies. We now see another shift in this gradual evolution, a shift to a much expanded "Information Services" department (sometimes Information Technology Group) where the components are the computing resources for the firm; the communications, both voice and data for the firm and thirdly the office automation/white collar productivity functions. A fourth component is the one often referred to as blue-collar productivity, but perhaps more usefully referred to as asset productivity. This is the area of robotics and process control which can have an enormous impact on the productivity of the work force as well as the productivity of the assets. This fourth area is still in an embryonic state and is being explicitly addressed by only a few leading firms. General Electric, for example, has made a number of organizational attempts to capture this technology as part of their strategic positioning for the 1980's.

Thus, it seems there is a term "information services" or "information technology" - IT - that is replacing the use of the terms "data processing" and "MIS" in organizations, and which captures the power and the shifting character of technological changes.

A Critical Metamorphosis - From Data Processing
to Information Technology

The "third era" managerial change noted just above has been necessitated by four powerful trends. These are: significant changes in computer hardware technology, communication technology, software technology, and data availability. That hardware technology is changing is well recognized. The rapidly decreasing cost of computer hardware and the frenzied reception of the new wave of personal (micro) computers has led many to predict that, within this decade, almost everyone handling information in a corporation will have a terminal on his/her desk. Most probably, this "terminal" will be a personal computer allowing both remote access to major databases and the ability to perform local computation with local storage of data at the particular user's desk .

Parallel to the computer hardware change, however, has been an equally explosive change in the technologies for data, text and graphics communication. Satellites, fiber optic systems, microwave communication and "local area nets" are now at the point where it is agreed that the "computer function" has now been transformed to the "computer communication function." Computer systems are today used increasingly not only to gather, store and process data but also to communicate both numerical data and qualitative information (text) throughout the corporation.

Equally significant, is the third major change in the technology - that of the increasing availability of a new generation of software. This new software allows users at all levels in the corporation to access

and use computer systems without the need to learn the rites of programming. Called "fourth generation" or "user-friendly" languages, this software today allows managers at all levels to use the computer without the one to three year wait associated with the production of systems by the company's data processing organization. Although such languages have been with us for approximately the past decade, it is only within the last two to three years that they have gone into widespread use.

Within this set of computer technology change is a fourth, less talked about but perhaps equally significant, change, which is the increasing availability of data for managers. It is common knowledge that the first two eras of accounting and operational application development have produced many internal databases which are of use to the management of an organization. Perhaps more important, as the hardware and software has evolved, are the organizations such as Dun & Bradstreet, DRI, Nielson, etc. which provide external data (e.g., industry data, competitive data, economic data). These firms have perceived an expanding market for their services and have moved aggressively to exploit this market. As a result, there are several thousand data bases containing the type of market, competitive, economic forecast, industry forecast, and other data which is perhaps even more useful to management levels above the first line supervisor than is the internally generated data. This data is provided, for a fee, in machine-readable format to be easily added to a company's computer systems.

As a result of these four trends, managers today have available to them, cost-effective hardware, communication capability, software

systems, and increasingly, the data necessary to allow them to be more informed than ever before in planning and monitoring the progress of their organizations. Equally significant, is the managers' capability to communicate both raw data and the result of the analyses through communication networks, such as an organization's electronic mail system and through presentation aids such as color graphics terminals. Most important, their ability to use this technology without a costly investment of both time and financial resources has been strikingly enhanced. We currently stand, we believe, at merely the "diaper" stage of the evolution of these technologies and their applications.

The new, third-wave of applications made feasible by these technological changes is impressive. To illustrate a few of the most significant of these, we have the following:

- The advent of "robotics" in the factory which will have a significant impact on the labor force.

- The increasing use of "decision support systems" at middle management and staff levels which is affecting both the process and content of decision making on semi-structured tasks.

- The availability of "information databases" such as IBM's marketing data base (a nine billion character database) which is making classes of data available to a wider segment of the corporation. (IBM's market research database now has in excess of one thousand users in the corporation, ranging from the market research division, to sales organizations world-wide, to other functional areas in the corporation having need of marketing data.)

- The recent evolution of "executive databases" a specific type of "information data base," now providing access by top executives to both internal and external data. This allows these executives to access data, and to perform analytic processes or to browse through the data themselves where they find this useful rather than having to delegate these functions to their staffs and thus lose direct contact.

- The rapidly growing implementation of "electronic mail" systems in many major corporations which allows effective point to point communication of messages, and the almost as quickly evolving development of electronic networks to allow inter-organizational communication.

- The not-as-rapid, but clearly evident, growth of many-to-many communication nets within corporations which allow a person to simultaneously communicate with others who share common interests (e.g., Procter & Gamble's research network, or IBM's VNET).

These examples are merely illustrative of the applications that are being instituted as the new technology becomes more widely available. This technology is now at a level of cost that permits its use in ways not previously possible. Most importantly, the technology now affects management and its actions as well as products and their markets. It has gone beyond the mere paperwork processing functions of the firm.

Our basic proposition, which we now go on to discuss is that this new technological era, with its concomitant applications, has major implications for the strategic positioning of the organization. At the very least it offers opportunities to manage the firm in increasingly efficient and effective ways. The technology can be harnessed more

significantly, however, when it is carefully focussed on those aspects of the firm which are particularly important to its strategy. Such support for aspects of the business that have strategic significance offers the opportunity to stay positioned with, or ahead of, one's key competitors. Our proposition, however, goes beyond the support of existing business strategies to the creation, through the innovative use of technology, of new corporate strategic moves. These moves can be into new products, new markets or the ability to so alter the cost structure of the firm as to put it in a whole new competitive position.

Conceptual Structure

The proposition enunciated above can be put in diagrammatic form as is shown in Exhibit 1. We would submit that at this point in time there are two principal driving forces which affect organizational strategies, personnel, processes, structure and technology. The external environment and the technology are two powerful forces that will put the other elements of an organization's processes, people, and structure into motion. This resulting motion is necessary to maintain the balance required for a firm to be effective. This conceptual structure follows directly from the pioneering theoretical and empirical work done by Harold Leavitt when he was at Carnegie Mellon University in 1958 and by Chandler while he was at M.I.T. in the 1950's. Although these two men came from quite different academic backgrounds and were doing research in entirely separate fields they quite independently came up with noticeably compatible points of view.

In Chandler's case he was interested in comparative business history and, as an historian, investigated the changing strategy and structure of large industrial organizations in the United States. As previously noted, he found that changes in an organization's structure had followed changes in the firm's strategy and that the organizational structure often had to be modified continuously until it was effective in supporting the firm's strategy. In his examination Chandler focused on individuals and their roles in organizations and organizational changes. He noted that particular individuals played unique and often crucial roles in developing the "fit" between the organization's evolving strategy and an appropriate structure. Many of the structural changes and the shifts in strategy noted by Chandler were caused by changes in the technology. For example, Dupont took advantage of some technological changes in the form of new chemical processes to move from being a munitions supplier to broaden its strategy into opening up the new field of industrial chemicals and becoming a dominant supplier there. Thus, one can readily recast Chandler's "structure follows strategy" into four of the five forces portrayed here, forces that he also identifies.

Coming from an entirely different direction Harold Leavitt¹⁰ concluded that any organizational analysis, particularly one that was trying to match people and organizations to ensure that a given task was to be accomplished effectively, should include the four components of task, technology, people, and organization structure. He saw one of management's key functions as being that of maintaining a dynamic equilibrium among these four forces. Although Leavitt's main interest was in the individual, and that person's fit with the organization, he

too came up with the four factors of task, technology, people and structure. The theoretical underpinnings of Leavitt's work came largely out of the field of social psychology and drew on the work of Chapple and Sayles⁶, Argyris¹, and others.

The Model

In our thinking, as summarized in Exhibit 1, we have particularized Leavitt and changed the generic task into the specific one of achieving the organization's strategy. This does no violation to his conceptual structure although we do go on to make two additions that Leavitt does not make specific reference to. These two additions are to include an additional box for "Management Processes" and to surround the four boxes characterizing the organization with a line representing a permeable membrane. This membrane leaves differing amounts of each element exposed to the external environment. Thus, the organization's strategy is affected directly by the environment in a major way while the individual and the structure are impacted less directly.

Management processes have been included in the middle as we see these as part of the glue that holds the organization together. Here we include such processes as that by which the strategic plan is created, as well as the processes of meetings, discussions and evaluation which result in the annual budget, the capital budget and all the functional plans, such as manufacturing and human resources, done by the departments. Every organization has such processes and they represent a good deal of what is done in an organization.

We have added to organization structure the very important dimension of corporate culture. This is an often misunderstood term but

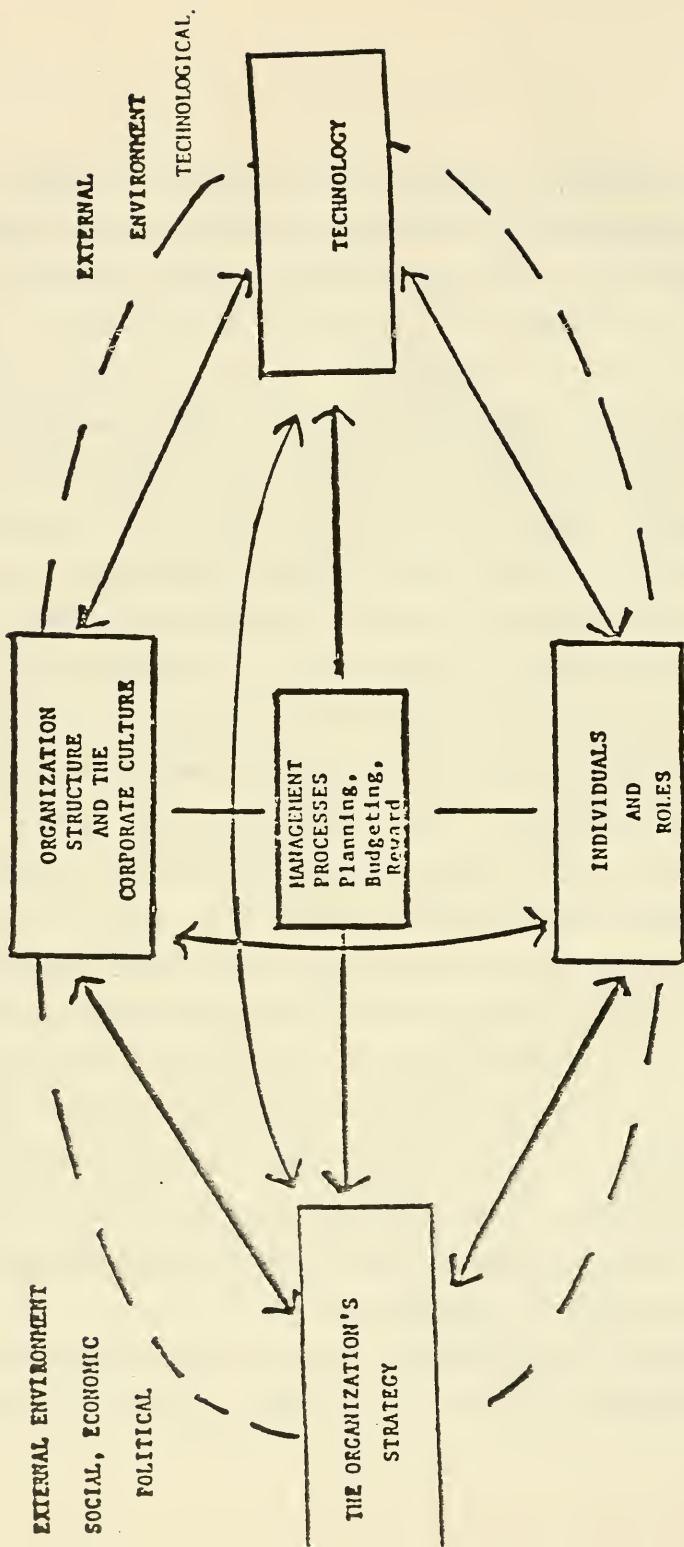


EXHIBIT 1

it seems to us that it is much of what makes some firms thrive and others with an identical structure and similar in most other respects, merely survive. Schein's work¹⁶ in this area has convinced us that this is a necessary explicit addition to Chandler's structural forces.

Some Illustrations of Significant Change

We have seen few published reports of significant changes in the structure and processes of organizations as a result of information technology since Leavitt and Whistler wrote in 1968. Robey, Bjorn Anderson, and a few others have noted some changes but they are far from widespread or corporation-shaking. This lack of change - as noted above - is due primarily to the way computer technology was designed and used during most of the past quarter century. The third era technology, however, is entirely different. As a result, we believe we see strong early indications that technology is now a very significant driving force which is impacting the other four elements in the conceptual model in Exhibit 1. Some examples of this are:

- The advent and growth of information databases at functional staff levels (marketing, purchasing, finance, personnel) appears to be having two, quite different effects in companies we have observed. In some, information formerly available only to a very small number of central staff people is now widely accessible by others throughout the corporation. In these organizations, since information is "power", it can be assumed that some of the power previously held closely by the marketing, purchasing, etc., staff is now more widely dispersed

throughout the organization. Greater access to data appears to be changing some of the roles in these organizations.

In other corporations almost exactly the opposite is happening. There, a centralized information data base is being developed, formed with data previously stored locally and accessible only by the local organizations. The central staff people now are able to provide increasingly more effective guidelines for local action (thereby constraining local action) and - even more constraining - get actively involved in what formerly were local decisionmaking processes. Again, processes and roles are shifting.

- We have not actively studied electronic mail. However, senior managers using it stress that their - and their organization's communication patterns - have changed significantly due to the ease of communicating with those in the organization (quickly scanning one's own communications, deciding which to answer immediately, and so forth). The evidence of this has yet to be quantified.

- The newest area of many-to-many communications¹⁷ (which can be viewed as electronic mail with multiple addressing and conferencing facilities) appears to have opened up several entirely new communication channels in organizations. In particular, this technology facilitates persons in different divisions and departments with similar interests in communicating with each other. Using this technology, for example, researchers throughout a widespread organization can remain in continual contact. Several more informed - and perhaps more united -

professional communities are thus appearing in some organizations. The negative aspects of this have been noted recently in an article on IBM's "Gripe Net."¹⁷ At IBM a particular software community, feeling that its product was being given too little attention in the company's product line, developed a more than slightly disturbing electronic communication comraderie. Whatever the result of these systems, whether positive or negative, it appears that communication is clearly enhanced and, from this, one would expect subtle, if not explicit and obvious changes in organizational life.

- The availability of video conferencing has allowed some organizations to geographically separate subgroups yet maintain the same level of eye-to-eye contact. An example of this is at Aetna where a systems development group has been located seven miles away from its users, yet it remains in direct contact with the users over a two-way videoconferencing link. The technology may thus enhance the ability to geographically disperse an organization.

A Critical Interaction: Technology and Strategy

However, it is the impact of Information Technology (IT) directly on an organization's strategy that perhaps has the most significant potential. This can be thought of in a variety of ways but one useful one is to look at it from the value-added-chain perspective. Pioneering work in the use of the value added chain has been done by some of the best corporate strategic planners (see, for example, Lewis¹²). For purposes of illustration here we will use published material (see Business Week⁴) on Foremost McKesson.

Foremost McKesson is a distributor and until fairly recently it had a singularly ordinary performance: mediocre returns, modest market position, average margins, and so forth. After a change in leadership, there was also a shift in attention to the company's use of information technology. Having reaffirmed their corporate strategy and purpose of being a distributor, management set about taking each step in their value added chain and devoting management time and attention to finding ways of executing each step as efficiently and effectively as possible. As is portrayed in Exhibit 2, this involved using the computer creatively in almost every step of the company's business. In purchasing it was used to keep more accurate forecasts of demand for individual items; in receiving, incoming items were checked carefully with invoices; and so on through each of the steps where the company added value to the products it distributed to its customers. Through this use of first and second era application of computer power the company kept more accurate track of its principal asset, inventory, and made more effective use of two other assets, its employees who could handle more items and its cash which was turned over more frequently. In short, the company began to do a thoroughly workmanlike job of using computers to support its existing business with its traditional methods.

The company then began to put computer terminals into their customers' premises (Exhibit 3) (in this purely illustrative example, drug stores). This allowed the customer to enter orders directly, in return for which the company guaranteed the customer delivery within a certain time, say, hypothetically twenty four hours. Notice that the customer was now doing the order-entry job for the Distributor thereby saving

the

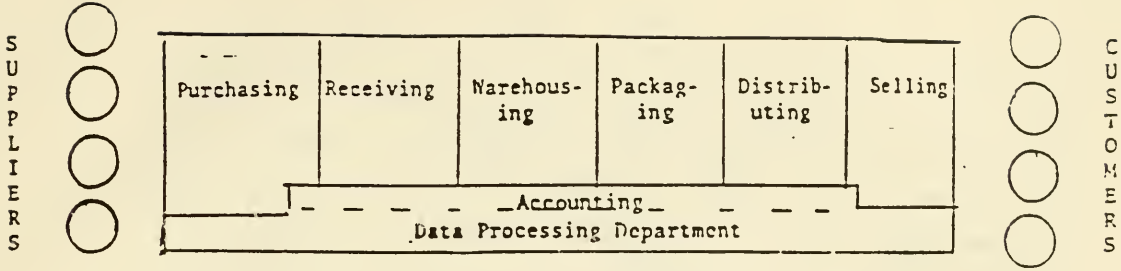


Exhibit 2

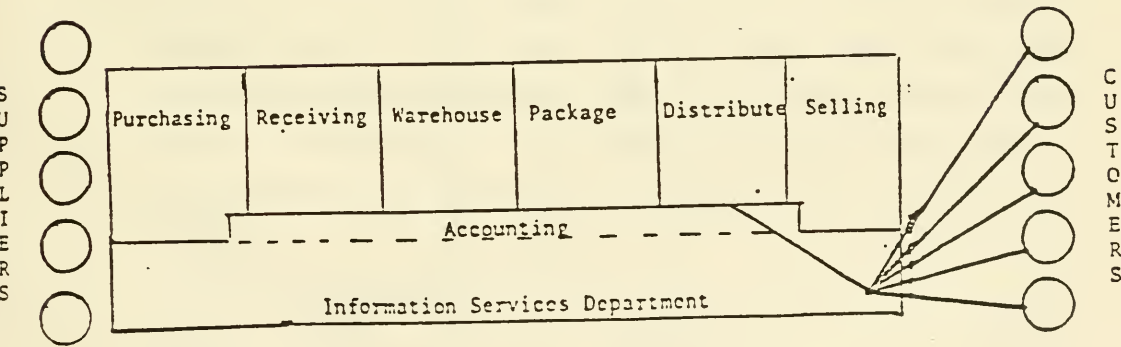


Exhibit 3

distributor a significant cost, however, as the customer could cut his inventory levels due to the guaranteed delivery, he was quite willing to add what was to him, the very low marginal cost of ordering his own supplies. Thus, at this first level of use the I.T. is helping in a major way to support the way the firm currently does business.

The real strategic use of the technology and payoff to the distributor came in the next two moves. First, as the customer began to request new items not previously carried by the distributor, there occurred a broadening of the product line by adding new items. In addition, of course, the customer's personnel were trained and familiar with the terminal which raised the switching costs if he were to try to move to a new supplier. Thus the distributor's information service department has begun to actively enhance the company's business strategy. Indeed it has become a vital part of linking the customer to the company. Going through the value-added steps is one way to assess where information technology can best be deployed to support the existing business thrust of the firm. However, as it is approached in practice the net result for some firms is to find whole new ways of accomplishing the mission of the firm. This proactive role of the IS department requires them to move out of the confines of the departmental boundaries and become closely involved with the business, its customers, suppliers and ways of doing business.

The interesting move occurred next, however. The distributor, by being tied in to his customer noticed that the end user often went to a third party (typically an insurance company) to get payment for the medicines and supplies that had been bought. The distributor then

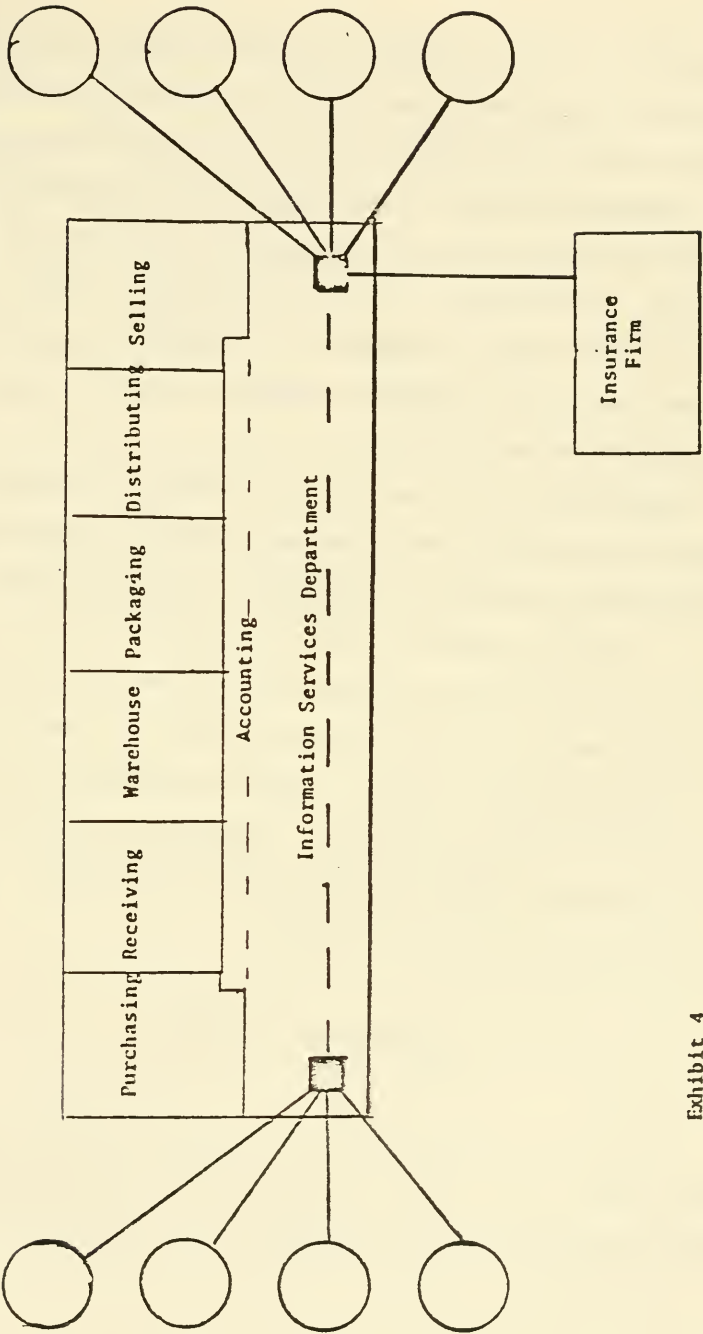


Exhibit 4

volunteered to collect the funds from the third party, thereby saving the drug store the cost of doing that job, and incidentally, speeding up the collection time for the distributor. This move not only provided a link to the insurance firm and with it a potential new customer, but it also provided a whole new product, claims processing and collection. Thus the distributor, of other people's manufactured products, opened up a whole new business strategy by acting as a middleman in the financial processing business. Information technology created a new strategic opportunity for the business.

This ability to use information technology to create new business strategies is potentially very important. This fact is well recognized in industries such as financial services (for example, Merrill Lynch's CMA) or in other information intensive industries such as publishing. McGraw-Hill has entered new businesses by acquiring such firms as DRI and has created new ways of doing business through the use of innovations such as the electronic bookshelf. There are hundreds of such examples in the information intensive industries. Somewhat surprisingly, the impact of I.T. is becoming evident in a wide range of industries - the previous example being just one such illustration.

Management in the 1990's

In the Sloan School at M.I.T. we are embarking on a research project which will identify situations where business strategies are being driven by information technology. This is being done with a view

toward understanding technology's effects on the four remaining elements in our conceptual structure. Putting all of this together, we hope to begin to understand the conditions under which a firm can expect to improve its competitive position with the use of information technology. Equally, we are hoping to begin to understand the implications of these moves for the firm and its management.

There is no doubt in our minds that management in the 1990's will be affected in major ways by information technology. Successful firms will be the ones who harness this technology and use it as a competitive weapon in their fight for survival and growth. We will try to understand this evolution and provide guidelines for change which will be useful to organizations. This is one important ingredient in strategic management for the 1990's.

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